



The Effect of Teacher's Scaffolding on Improving the Inner Speech of EFL Learners: Moderated by the Behavioral Inhibition/Activation Systems

Zhila Balegh 

PhD Candidate of English Language Teaching Department, Sara. C., Islamic Azad University, Sarab, Iran.

zhila.balegh@iau.ac.ir

Shima Ahmadi-Azad  (Corresponding Author)

Assistant Professor of English Language Teaching Department, Sara. C., Islamic Azad University, Sarab, Iran.

sh.ahmadiazad@iau.ac.ir

Mohammad Hossein Yousefi 

Assistant Professor of English Language Teaching Department, Sara. C., Islamic Azad University, Sarab, Iran.

yousefi@iau.ac.ir

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Abstract

Understanding the interplay between the social (teacher scaffolding), cognitive (inner speech [IS]), and psychological (behavioral inhibition/activation systems [BIS/BAS]) factors involved in language development, can be crucial in designing effective language instruction. This research investigated the impact of teacher scaffolding on Iranian English as a foreign language (EFL) learners' IS, moderated by BIS/BAS sensitivity. A sample of 58 advanced EFL learners was selected through purposive sampling based on Oxford Quick Placement Test results and assigned to two groups. The experimental group (n=28) received instruction through teacher scaffolding, and the control group (n=30) received the conventional teaching methods. To assess learners' BIS/BAS, the Gary-Wilson Personality Questionnaire was utilized, and Varieties of IS Questionnaire-Revised was applied in pretest and posttest phases to measure learners' IS. Results of the analysis of covariance revealed that teacher scaffolding could significantly enhance learners' IS and supported its effectiveness as a pedagogical strategy. Although BAS sensitivity did not have a significant impact on IS development, BIS sensitivity could significantly inhibit IS, suggesting that the anxiety and fear of negative evaluation can adversely affect cognitive processes. The findings have important implications for considering both social and emotional factors when designing EFL pedagogical strategies.

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Introduction

Language learning occurs at the intersection of mind and interaction, where learners gradually transform external linguistic input into internal tools for thought and communication (Britton et al., 2023; De Guerrero, 2018). Teacher scaffolding and inner speech (IS), grounded in Vygotsky's (1987) sociocultural theory (SCT) and zone of proximal development (ZPD), are two influential and interconnected factors throughout this transformation. Scaffolding provides a supportive bridge between learners' current competence and emerging potential, while IS refers to silent self-talk through which learners regulate cognition and internalize new knowledge. Yet, this internalization does not occur in an affective vacuum. Learners' emotional orientations, particularly their behavioral inhibition and activation systems (BIS/BAS), can shape how they respond to instructional support (Hung & Nguyen, 2022; Lantolf & Thorne, 2006).

IS refers to the internalized use of language to organize thoughts, rehearse, and self-regulate learning (Alderson-Day & Fernyhough, 2015). According to Vygotsky (1978), IS acts as a transitional phase between social interaction and autonomous language use, essential for learners to consolidate language structures mentally before producing them without external mediation. EFL teachers should pay careful attention to IS because it represents a critical component of language learning for enhancing cognitive development and autonomous language use (Carruthers, 2018; Lantolf & Poehner, 2008). However, empirical research on mechanisms that scaffold IS development in SLA, particularly in EFL contexts, remains limited.

From a Vygotskian perspective, IS development is intrinsically tied to mediation, which is the use of symbolic and cultural tools to facilitate cognitive development. Mediation in SLA often takes the form of scaffolding, where a more knowledgeable other provides dynamic support to help learners accomplish tasks within their ZPD and internalize linguistic constructs (Lantolf & Poehner, 2008; Vygotsky, 1978). Although extensive research has supported teacher scaffolding's effectiveness in promoting communicative skills (e.g., Albalawneh & Tepsuriwong, 2020; Li et al., 2024), understanding how scaffolding interacts with learners' psychological characteristics to shape IS remains rare.

While scaffolding might support IS development, learners' individual differences, such as BIS/BAS sensitivities, may influence how effectively they internalize scaffolded input. Grounded in Gray's (1982) biopsychological theory, BIS reflects responses to punishments or fear of failure, while BAS governs drive toward rewards and positive outcomes. These systems can influence motivation, engagement, and cognitive readiness in language learners (Bilge & Emiral, 2022; Firoozjah et al., 2022). Learners with overactive BIS usually experience high anxiety in EFL contexts, possibly hindering their ability to internalize scaffolded input. Conversely, learners with strong BAS likely exhibit enthusiasm and engagement with scaffolded tasks, potentially accelerating IS enhancement.

This investigation explored the role of teacher scaffolding in improving Iranian EFL learners' IS, moderated by BIS/BAS sensitivity. This study addressed the gap in understanding IS development mechanisms in SLA by focusing on teacher scaffolding and the moderating influence of BIS/BAS. The findings could provide EFL teachers with effective strategies for

adjusting instructional practices to meet learners' different needs, particularly crucial for Iranian EFL settings where high-stakes examinations and societal expectations amplify demand for personalized teaching approaches.

1. Literature Review

1.1 Inner Speech (IS) in SLA

Inner speech (IS), recognized as a genuine form of speech introspectively accessible to individuals, is an area of interest in philosophy, linguistics, neuroscience, and developmental psychology. Gregory and Langland-Hassan (2024) provide a comprehensive philosophical overview, noting that IS encompasses both condensed linguistic fragments and fully articulated propositions, challenging the notion that all thought is necessarily linguistic. Furthermore, Buschman and Miller (2023) emphasized the role of cognitive control networks in working memory, suggesting that IS may function as one mechanism supporting the phonological loop involved in the storage and rehearsal of verbal information. Recent neuroscientific perspectives by Aboitiz et al. (2025) propose that the hippocampus plays a crucial role in the development and evolution of IS, suggesting that IS emerges from the interaction between memory systems and language networks. This iterative process reduces cognitive load and improves retention, facilitating tasks like reading and writing (Baddeley, 2020). Studies reveal that IS enhances text comprehension and allows learners to integrate and extract important details (Daneman & Newson, 1992).

IS also fosters self-reflection and metacognition, allowing learners to monitor progress, refine thoughts, and adjust linguistic output (Bermúdez, 2003; Carruthers, 2018). Racy and Morin (2024) demonstrated that IS is positively associated with self-regulation, mindfulness, and self-concept clarity in university students, while also showing complex relationships with mind wandering, underscoring IS's dual role in both focused cognition and spontaneous thought. Additionally, it supports executive functions such as planning, task-switching, and error inhibition (Alderson-Day & Fernyhough, 2015), while aiding perspective-switching during communication (Fernyhough, 2016). Petrolini et al. (2020) examined IS's role in executive functioning among individuals with schizophrenia and autism spectrum conditions, revealing that disruptions in IS can impair goal maintenance and cognitive flexibility. Miyake et al. (2004) further established that IS serves as a retrieval aid for task goals, particularly when cues are verbal, and that articulatory suppression significantly impairs task-switching performance, confirming IS's functional necessity in executive control. Moreover, Akiba (2025) introduced the verbal-cognitive scaffold (VCS) model, which conceptualizes IS as a cognitive scaffold that mediates computational thinking and problem-solving, highlighting IS's role in bridging verbal processes and higher-order cognition.

Regarding language used in IS, Dewaele (2015) claims that L1 is typically dominant, especially for emotional functions. However, L2 use increases with proficiency, frequency of daily use, early acquisition, and acculturation. Context and task type strongly influence language choice and code-switching in IS (Gabryś-Barker, 2015). Neuroimaging research shows structural brain changes in bilinguals' language-related regions during L2 IS, indicating cognitive demands of L2 use (Alderson-Day & Fernyhough, 2015).

While there is consensus on the significance of IS as a rehearsal mechanism and cognitive scaffold, not all theorists agree on its precise nature. Some argue IS represents linguistically mediated thoughts rather than constituting thought itself (Jackendoff, 1996). Kompa (2024) critically examines whether we think “in” language, arguing that while IS often accompanies thought, pure conceptual thought can occur independently of linguistic encoding, suggesting IS is a tool for thought rather than thought itself. Moreover, Yao (2025) offers a reconceptualization of IS through the framework of linguistic active inference, proposing that IS functions as a predictive mechanism that continuously updates internal models of language and cognition, thereby integrating perception, action, and thought. Despite these debates, IS remains key in understanding cognitive and linguistic mechanisms of SLA. Further, Camminga et al. (2025) demonstrated that IS can play a significant role in emotion recognition among children with and without developmental language disorder, suggesting that IS is not only a cognitive tool but also an affective-regulatory mechanism that supports emotional processing in language learners. The limited exploration of IS in pedagogical contexts demonstrates the need for examining teaching interventions, such as scaffolding, that support learners' transition from external speech to autonomous IS.

1.2. Teacher Scaffolding and Learners' IS

The positive consequences of teacher scaffolding have been reported in different areas of English teaching including speaking (Tran & Luu, 2022), reading comprehension (Fatehi Rad & Jalali, 2021), writing (Pishadast et al., 2022), listening (Albalawneh & Tepsuriwong, 2020), grammatical knowledge (Ghanizadeh & Mousavinejad, 2023), and vocabulary (Jamali Kivi et al., 2021). Taken together, these studies indicate that scaffolding can facilitate learners' performance by providing calibrated support that helps them manage task demands, focus attention on essential linguistic features, and gradually enhance their autonomous language use across the targeted skills.

Recent research by Maisarah and Motevalli (2025) further explored the role of teacher scaffolding in fostering independent learning, emphasizing that scaffolding strategies enable learners to transition from teacher-dependent to self-regulated learning behaviours. Wu and Song (2026) distinguished between affective and instructional scaffolding, finding that affective scaffolding significantly enhanced emotional engagement and social attention during learning activities, suggesting that the emotional dimension of scaffolding is as critical as its cognitive dimension. One essential mechanism linking teacher scaffolding and learner autonomy is IS, a cognitive tool allowing learners to rehearse and internalize skills independently (Lantolf & Poehner, 2008). When integrated with IS, scaffolding becomes a powerful method for transferring knowledge and fostering linguistic and cognitive independence.

Lantolf and Poehner (2008) found that dynamic scaffolding strategies such as guided questioning, simplified input, corrective feedback, and collaborative tasks helped learners internalize linguistic knowledge and use it during silent cognitive rehearsal. Aljaafreh and Lantolf (1994) demonstrated that scaffolding helped learners transition from reliance on external feedback to self-correction and metacognitive awareness—key elements of effective IS.

Research by De Guerrero and Villamil (2000) revealed how teacher-led scaffolding encouraged private speech development, a precursor to IS. Scaffolded peer interaction contributed to L2 learners' ability to monitor and reflect on their language output. Similarly, Swain et al. (2015) emphasized that output-driven activities supported by scaffolding provided fundamental conditions for developing reflective IS. However, despite such findings, limited understanding exists of how scaffolding interventions contribute to IS development in advanced-level EFL environments.

1.3. BIS/BAS in IS Development

Although direct studies on BIS/BAS and language learning are limited, these systems offer a framework for understanding how approach and avoidance tendencies might influence learners' engagement and cognitive processes. Earlier research has explored related constructs such as anxiety, motivation, and risk-taking behavior associated with BIS and BAS (Carver & White, 1994; Smillie et al., 2006). Individuals with high BIS usually exhibit greater anxiety and inhibition, leading to increased self-monitoring and fear of negative evaluation, thereby impacting performance. Individuals with high BAS demonstrate more approach-oriented behaviors and enthusiasm, positively influencing their performance (Balconi & Mazza, 2010). Maji et al. (2024) found that punishment sensitivity—a core feature of BIS—serially mediates the relationship between procrastination and academic satisfaction through increased depression, highlighting how avoidance motivation can undermine academic outcomes.

According to Balconi et al. (2024), BIS and BAS interplay influences students' emotional regulation and responses to academic stressors. High BIS individuals are more prone to anxiety in response to academic demands, while high BAS individuals are more resilient and responsive to positive reinforcement. Entezari et al. (2022) found that memory performance in the BAS group with positive emotional reception surpassed other groups.

Since no direct evidence exists about BIS/BAS sensitivity's role in EFL learners' IS, indirect relationships can be referenced. According to Swain et al. (2015), learners with strong BIS traits may struggle with transitioning from external speech to reflective IS due to heightened self-monitoring or fear of errors, whereas BAS-dominant learners may thrive under scaffolding interventions rewarding task mastery. Related studies indicate that ruminative IS is often linked to higher neuroticism (corresponding with BIS tendencies), as anxiety-prone individuals may engage in more negative self-talk (Łysiak, 2019; Puchalska-Wasyl & Oleś, 2013). Conversely, individuals with strong BAS more frequently engage in positive self-talk and constructive inner dialogues (Carver & White, 1994).

Overall, existing literature highlights IS's importance in SLA, teacher scaffolding's role in cognitive development, and BIS/BAS traits' influence on learner engagement. However, limited research directly investigated scaffolding's effect on IS development among advanced EFL learners, and BIS/BAS systems' moderating effects on SLA outcomes remain underexplored. Thus, to address the gap in literature, the current study examined the following research questions:

RQ1: Does teacher scaffolding significantly enhance IS development in Iranian EFL learners compared to conventional teaching methods?

RQ2: Does BAS sensitivity moderate the relationship between teacher scaffolding and IS development?

RQ3: Does BIS sensitivity moderate the relationship between teacher scaffolding and IS development?

2. Materials and Methods

2.1. Research Design

This study adopted a pretest-posttest quasi-experimental quantitative design to investigate the effect of teacher scaffolding (i.e. independent variable) on enhancing IS (i.e., dependent variable) of Iranian EFL learners, moderated by BIS/BAS sensitivities (i.e., moderating variable). A pretest assessed baseline IS abilities and was used as a covariate to control preexisting differences.

2.2. Participants

Participants included 60 advanced EFL learners aged 18–22 (60% female, 40% male) from Cactus English Language Institute in Bonab, Iran, selected by purposive sampling from 79 candidates who completed the Oxford Quick Placement Test (OQPT). Although purposive sampling was appropriate for accessing learners with the required proficiency profile, this approach naturally limits the generalizability of the findings beyond similar instructional contexts. All participants scored within the advanced proficiency range. Following recruitment, participants were randomly assigned to experimental ($n=30$) and control ($n=30$) groups. Due to absences exceeding three sessions, two individuals were removed from the experimental group, resulting in a final sample of 58 (experimental $n=28$; control $n=30$). A check for potential attrition bias was conducted using participants' initial OQPT scores, which indicated no substantive differences between those who withdrew and those who completed the study. This sample size yielded an a priori estimated power of 0.81 based on G*Power calculations, and it also facilitated the provision of personalized scaffolding (Gibbons, 2002). Ethical considerations were addressed through informed consent, confidentiality assurance, and withdrawal options.

2. Instruments

2.1 Oxford quick placement test

The Oxford Quick Placement Test (OQPT) was utilized initially to confirm the participants' homogeneity according to their current English proficiency level. It includes 60 multiple-choice questions assessing learners' grammar and vocabulary knowledge. According to the scoring manual of OQPT suggested by the Council of Europe (CEFR, 2009), the advanced level included the scores ranging between 48 to 60. Numerous previous studies (e.g., Abbasi Dogolsara et al., 2022) have confirmed the test's reliability and construct validity. In the present study, the OQPT was piloted with a similar small sample size ($n = 15$), and its internal reliability was assessed and confirmed using Cronbach's alpha coefficients ($\alpha = 0.80$). Furthermore, a panel of experts supported its validity.

2.2. Gray-Wilson Personality Questionnaire (GWPQ)

The 120-item original English version of the Gray-Wilson's Personality Questionnaire (GWPQ), developed by Wilson et al. (1989), assessed the participants' BIS/BAS. Given the advanced proficiency level of the participants, the questionnaire was administered in English to preserve reliability. Following Slobodskaya et al.'s (2001) factor analysis, BAS comprised items of Fight, Active Avoidance, and Approach, while BIS items came from Flight, Passive Avoidance, and Extinction scales. For each item, three options exist: yes, no, and don't know. For items with minus sign, "Yes"=0, "Don't know"=1, "No"=2; for plus sign items, "Yes"=2, "Don't know"=1, "No"=0 (modeled by Mohammadi Shirmahaleh, et al., 2017). The previous literature (e.g., Slobodskaya et al., 2001; Wilson et al., 1989) confirmed the internal reliability and validity of GWPQ, however, for the current study, the questionnaire was piloted to support its reliability by Cronbach's alpha coefficients ($\alpha=0.91$). Meanwhile, a panel of experts—two in educational psychology and one in personality assessment—reviewed the GWPQ items and confirmed its content validity.

2.3. Varieties of IS Questionnaire-Revised

Varieties of IS Questionnaire-Revised (VISQ-R), developed by Alderson-Day et al. (2018), provided a comprehensive framework for understanding various dimensions of the IS (i.e., condensed, other people, dialogic, evaluative/critical, & positive/regulatory) that are relevant in educational contexts. The positive/regulatory category is particularly pertinent for examining scaffolding's impact, including supportive IS such as self-encouragement. The 35-item questionnaire used a 4-point Likert scale (never=1 to always=4). While Alderson-Day et al. (2018) established a good level of reliability and validity for the VISQ-R, this study conducted a pilot test and confirmed the internal reliability ($\alpha=0.89$) and validity of the instrument.

2.4 Procedure

After piloting the questionnaires, all 79 initial candidates first completed the OQPT to determine their English proficiency level. Based on these results, 58 eligible learners were selected for the study. These participants then completed the IS questionnaire to assess baseline IS and the GWPQ to measure their BIS/BAS profiles. Following this, the 58 qualified learners were randomly assigned to the experimental ($n = 28$) and control ($n = 30$) groups. The study was conducted over eight weeks (16 sessions of 90 minutes twice weekly). Headway Advanced textbook (5th Edition) was taught to both groups. All instructional content, teacher, materials, and speaking-focused activities were identical across groups. The only difference was presence or absence of teacher scaffolding during task implementation.

The experimental group received explicit teacher scaffolding designed to facilitate the participants' IS development through the guided internalization of the linguistic forms. The instructional sequence followed a gradual release of the teacher's responsibility. The teacher first introduced the speaking tasks (i.e., role-plays, debates, problem-solving discussions; Gibbons, 2002) and explicitly modeled the IS process and described how learners should mentally rehearse their responses before the verbalization. During the task performance, the teacher provided some real-time scaffolding through the prompting questions to stimulate

mental planning, recasting to refine linguistic accuracy, guided questioning to encourage reflective self-regulation, and immediate feedback on speaking accuracy and fluency. Moreover, the participants were explicitly instructed to engage in silent IS rehearsal and also to reflect on their mental planning and adjustments before speaking. Gradually, the teacher scaffolding was progressively reduced as learners demonstrated increased autonomy in IS use. Then, the participants could complete the tasks with minimal teacher intervention and relied primarily on their own self-regulated IS processes.

In contrast, in the control group the same speaking tasks were conducted without any teacher scaffolding. In this group, the teacher provided some clear task instructions and the procedural guidelines but did not model or explicitly mention the IS processes. The participants completed the tasks independently or in pairs/groups. The teacher monitored the task completion and provided the post-task feedback on the language use, but did not prompt any silent rehearsal, mental planning, or reflective self-regulation, and also did not use any recasting, guided questioning, or real-time corrective feedback during the task performance. Thus, the participants completed tasks independently with only post-task feedback.

Then, both groups completed a posttest identical to the pretest to measure their improvements in the IS development.

2.5 Data Analysis

Descriptive statistics summarized quantitative data from OQPT, BAS/BIS scores, and pretest/posttest IS data. Shapiro-Wilk test assessed normality of score distributions. Levene's test measured homogeneity of variances, and homogeneity of regression slopes was tested to ensure ANCOVA assumptions were met. ANCOVA examined differences in posttest IS scores with BIS/BAS measures and pretest IS scores as moderators. Effect size values (partial eta-squared, η^2) evaluated practical significance. All analyses used SPSS 25 with alpha set at .05.

3. Results

3.1. Descriptive Statistics

The OQPT descriptive statistics for the experimental group were $M = 51.39$, $SD = 4.73$, and for the control group $M = 52.50$, $SD = 4.09$. An independent samples t-test revealed no statistically significant difference between the groups, $t(56) = -0.96$, $p = 0.34$, Cohen's $d = 0.25$, suggesting a small effect size. Therefore, the two groups were considered homogeneous in terms of language proficiency prior to the treatment.

Table 1 presents the mean and standard deviation of the BAS, BIS, and IS pre-test and post-test scores for the experimental and control groups. It is essential to note that the scores of BAS and BIS systems, acting as moderating variables in this study, were measured exclusively during the pre-test phase.

Table 1. Descriptive Statistics Related to BAS/BIS and IS Pretest and Posttest by Group

Variable	Group	Number	Mean	Standard Deviation
BAS System	Experimental	28	49.17	5,21
	Control	30	42,20	8,12
BIS System	Experimental	28	37	4,54
	Control	30	39,95	7,26
IS Pre-test	Experimental	28	84.67	9.95
	Control	30	67.40	9.84
IS Post-test	Experimental	28	102.89	8.39
	Control	30	88.80	9.21

3.2. Normality and Homogeneity Tests

Before conducting the ANCOVA, the normality of IS pretest and posttest scores and BAS/BIS values was assessed using the Shapiro-Wilk Test. Although the Shapiro-Wilk test (Table 2) indicated a slight deviation from normality for the experimental group's IS pre-test ($p = 0.028$), ANCOVA is robust to the minor violations with the sample sizes exceeding 25 per group (Glass et al., 1972). Therefore, the analysis proceeded with $\alpha = 0.05$.

Table 2. Results of Shapiro-Wilk Test for Normal Distribution of Scores

Variable and Test Phase	Group	Statistics	Df	Sig.
IS Pre-test	Experimental	0.88	28	0.028
	Control	0.96	30	0.498
IS Post-test	Experimental	0.97	28	0.723
	Control	0.96	30	0.547
BAS	Experimental	0.96	28	0.352
	Control	0.94	30	0.089
BIS	Experimental	0.97	28	0.623
	Control	0.95	30	0.174

Moreover, homogeneity of regression slopes was confirmed, as the interaction between the covariates and the independent variable was non-significant ($p > 0.05$). Furthermore, Levene's test for homogeneity of variance was non-significant, $F(1, 56) = 1.23$, $p = 0.272$, confirming equal variances across groups. Thus, all the assumptions were met for ANCOVA.

3.3. Analysis of Covariance (ANCOVA)

3.3.1. Results of the First Research Question

To address the first research question examining whether teacher scaffolding could significantly enhance IS development, the ANCOVA results (Table 3) revealed that after controlling for the IS pre-test scores, BAS sensitivity, and BIS sensitivity, a statistically significant main effect emerged for the instructional method, $F(1, 52) = 33.29$, $p < .001$, $\eta^2 = 0.39$, observed power = 1.00. This large effect size indicates that instructional method accounted for 39% of the partial variance in posttest IS scores.

Table 3. Analysis of Covariance for IS Post-Test Scores

Source of Changes	Sum of Squares	Df	Mean Square	F	Sig.	Eta Squared	Observed Power
IS Pre-test	1247.83	1	1247.83	21.45	< .001	.29	.99
BAS	198.72	1	198.72	3.42	0.070	.06	.44
BIS	278.91	1	278.91	4.79	0.033	.08	.58
Group (Main Effect)	1937.24	1	1937.24	33.29	< .001	.39	1.00
Group × BAS	42.35	1	42.35	0.73	0.397	1.00	.10
Group × BIS	268.14	1	268.14	4.61	.035	.08	.56
Error	3024.67	52	58.17				
Total	351068.00	58					

Regarding the covariates, the IS pre-test significantly predicted post-test performance, $F(1, 52) = 21.45$, $p < .001$, $\eta^2 = .29$, whereas BAS did not reach significance ($p = .070$). BIS showed a statistically significant effect ($p = .033$), suggesting a meaningful contribution after adjusting for other factors.

Pairwise comparisons of the adjusted means (Table 4) revealed that the experimental group ($M_{\text{adj}} = 104.49$, $SE = 1.45$) significantly outperformed the control group ($M_{\text{adj}} = 88.51$, $SE = 1.39$), with a mean difference of 15.98 points (95% CI [12.84, 19.12], $p < .001$). g of 2.08 indicates a very large effect.

Table 4. Adjusted Means and Pairwise Comparisons for IS Post-Test Scores by Instructional Method

Group	Adjusted M	SE	95% CI		
Experimental	104.49	1.45	[101.57, 107.41]		
Control	88.51	1.39	[85.71, 91.31]		
Pairwise Comparison					
Comparison	Mean Difference	SE	<i>P</i>	95% CI	Cohen's d
Experimental vs Control	15.98	1.57	<.001	[12.84, 19.12]	2.08

3.3.2. Results of the Second Research Question

To address the second research question regarding whether BAS sensitivity could moderate the relationship between teacher scaffolding and IS development, the results of ANCOVA (Table 3) revealed that the interaction term Group × BAS was not statistically significant, $F(1, 52) = 0.73$, $p = .397$, $\eta^2 = .01$. Although the effect size was modest, the interaction was not statistically significant at $\alpha = .05$. This indicates that learners' sensitivity to reward and approach motivation (BAS) does not significantly moderate how they benefit from scaffolding.

To further explore this marginally significant trend, the pattern of adjusted means across BAS levels was examined. When BAS scores were dichotomized at the median (Low BAS: scores < 42; High BAS: scores ≥ 42), the experimental group showed gains over the control group for both low-BAS learners (mean difference=14.73 points) and high-BAS learners (mean difference=17.23 points). Although high-BAS learners showed a numerically larger gain, this 2.50-point difference in the scaffolding effect was not statistically reliable, as indicated by the non-significant interaction term.

3.3.3. Results of the Third Research Question

To address the third research question considering whether BIS sensitivity could moderate the relationship between teacher scaffolding and IS development, the ANCOVA results (Table 3) revealed that the interaction term Group $\times$ BIS was statistically significant $F(1, 52) = 4.61$, $p = .035$, $\eta^2 = .08$ (see Table 5). This small-to-medium effect indicates that BIS significantly moderated the effect of scaffolding on IS development.

To interpret this interaction, simple slopes analysis examining the effect of scaffolding at three levels of BIS: low (-1 SD below the mean), mean, and high ($+1$ SD above the mean) was conducted. As shown in Table 5, scaffolding significantly enhanced IS at all three BIS levels, but the magnitude of the effect varied systematically with BIS sensitivity.

Table 5. Simple Slopes Analysis: Effect of Scaffolding on IS at Different Levels of BIS Sensitivity

BIS Level	b	SE	t	p	95% CI	Cohen's d
Low BIS (-1 SD)	18.42	2.21	8.33	< .001	[14.05, 22.79]	1.62
Mean BIS	15.98	1.92	8.32	< .001	[12.18, 19.78]	1.41
High BIS ($+1$ SD)	13.54	2.24	6.04	< .001	[9.11, 17.97]	1.20

The simple slopes analysis showed that for low-BIS learners (those with lower anxiety sensitivity), scaffolding was associated with an estimated gain of 18.42 points over conventional instruction, representing a large effect ($d = 1.62$). For learners at the mean level of BIS, the scaffolding advantage was 15.98 points ($d = 1.41$), and for high-BIS learners (those with higher anxiety sensitivity), the advantage remained statistically significant but was reduced to 13.54 points ($d = 1.20$). This pattern aligns with the significant interaction reported earlier, $F(1, 52) = 4.61$, $p = .035$, $\eta^2 = .08$, indicating that higher BIS sensitivity was associated with a gradual reduction in the magnitude of the scaffolding benefit.

Importantly, however, scaffolding continued to yield substantial gains across all BIS levels, including for high-BIS learners. Thus, while anxiety sensitivity moderated the effectiveness of scaffolding, it did not negate its positive impact.

4. Discussion and Implications

This study examined whether teacher scaffolding could enhance IS among Iranian EFL learners and whether this effect was moderated by BIS/BAS sensitivity. Findings revealed that teacher scaffolding significantly enhanced IS, while no evidence was found that BAS played a role in this enhancement. In contrast, BIS did not inhibit IS directly; it moderated the effect, suggesting individual differences in sensitivity to punishment and anxiety affect IS development.

4.1. Teacher Scaffolding Significantly Enhanced Inner Speech

Addressing the first research question, the findings revealed that teacher scaffolding produced a very large effect on IS development ($d=2.08$). This result provides strong empirical support for Vygotsky's (1978) sociocultural theory, specifically that external social interaction can be internalized as cognitive tools. This substantial effect size demonstrates that scaffolding is transformative for IS development in EFL contexts.

This finding extends previous research importantly. While numerous studies have documented scaffolding's effectiveness for external language production (Albalawneh & Tepsuriwong, 2020; Li et al., 2024; Tran & Luu, 2022), this study, to the best of our knowledge, provides the first empirical evidence that scaffolding also enhances internal cognitive processes. This suggests scaffolding facilitates transition from interpsychological (social) to intrapsychological (individual) functioning, as Vygotsky theorized, by helping learners internalize regulatory functions initially provided by the teacher.

The mechanism likely involves what Lantolf and Thorne (2006) describe as "graduated assistance", which is systematic adjustment of support based on learners' emerging capabilities. The intervention included linguistic support (simplifying structures, providing vocabulary), affective support (encouragement, positive feedback), and metacognitive support (modeling self-questioning, making thinking visible). These strategies provided learners with external models of self-regulatory language that eventually becomes internalized as IS.

The large effect size also suggests conventional instruction may be insufficient for promoting IS development in EFL contexts. Iranian EFL learners typically experience teacher-centered, grammar-focused instruction with limited meaningful interaction opportunities (Fatehi Rad & Jalali, 2021). Without explicit scaffolding, learners may struggle to transform external linguistic input into internal cognitive tools. These findings indicate intentional, responsive scaffolding can dramatically accelerate internalization.

4.2. BAS Sensitivity Did Not Moderate Scaffolding Effectiveness

Addressing the second research question and contrary to the expectations based on Gray's (1982) biopsychological theory, BAS sensitivity did not significantly moderate the scaffolding-IS relationship ($p = .070$, $\eta^2 = .06$). This null finding is theoretically informative, suggesting that approach motivation and reward sensitivity can play a less critical role in IS development than anticipated.

Several explanations may account for this unexpected result. First, IS development may be more strongly influenced by the threat-related emotions (BIS) than the reward-related emotions (BAS) because language learning in high-stakes EFL contexts like Iran is characterized more by anxiety and fear of failure than by excitement and reward-seeking (Firoozjah et al., 2022). When the dominant emotional tone is anxiety rather than enthusiasm, threat sensitivity may overshadow approach motivation in determining learning outcomes.

Second, the scaffolding intervention itself may have been sufficiently engaging to activate all learners' approach systems regardless of their baseline BAS sensitivity. If scaffolding created a universally supportive and rewarding environment, individual differences in reward sensitivity may have become less relevant. This interpretation aligns with research showing that well-designed instruction can reduce the impact of individual differences by meeting diverse learners' needs (Hung & Nguyen, 2022).

Importantly, the absence of BAS moderation does not diminish the value of scaffolding; rather, it suggests that scaffolding's benefits are relatively robust across different levels of approach motivation. This is pedagogically encouraging, indicating that teachers need not

worry that scaffolding will only help highly motivated learners because it appears effective regardless of learners' reward sensitivity.

4.3. BIS Sensitivity Significantly Reduced Scaffolding Benefits (RQ3)

Addressing the third research question, BIS sensitivity significantly moderated scaffolding effectiveness ($p=.033$, $\eta^2=.08$), with high-BIS learners showing 26.5% reduced benefits compared to the low-BIS learners. While scaffolding remained effective even for anxiety-prone learners ($d=1.20$, still a large effect), the systematic reduction of IS across BIS levels reveals that anxiety interferes with the internalization of scaffolded input.

This finding aligns with and extends previous research on anxiety in language learning. MacIntyre and Gardner (1994) demonstrated that foreign language anxiety impairs cognitive processing, particularly working memory and attention which are the important mechanisms through which IS operates. The results of this study suggest that this anxiety-cognition interference persists even when instructional support is present. High-BIS learners, characterized by heightened sensitivity to threat and fear of negative evaluation (Gray, 1982), may experience scaffolding simultaneously helpful and anxiety-provoking: helpful because it provides support, but anxiety-provoking because it draws attention to their current limitations and potential for error.

The simple slopes analysis revealed that low-BIS learners gained 18.42 points from scaffolding, while high-BIS learners gained only 13.54 points, with a 4.88-point difference. This reduction is likely reflected in several anxiety-related processes. First, high-BIS learners may engage in excessive error monitoring, using IS primarily for self-criticism ("I'm making mistakes," "This is too hard") rather than productive self-regulation ("What strategy should I try?"). Research by Morin (2005) and Alderson-Day and Fernyhough (2015) shows that anxiety increases the frequency of negative self-talk, which may crowd out the constructive IS that scaffolding aims to develop.

Furthermore, anxiety may reduce learners' cognitive capacity for processing scaffolded input. When working memory is partially occupied by worry and threat monitoring, fewer resources remain for encoding and internalizing the teacher's supportive language (Eysenck et al., 2007). High-BIS learners may hear the teacher's scaffolding but struggle to transform it into the internal self-regulatory speech because their cognitive resources are diverted to anxiety management. Moreover, fear of the negative evaluation may cause high-BIS learners to avoid the very engagement that scaffolding requires.

More importantly, our finding that scaffolding remained effective even for high-BIS learners ($d = 1.76$) shows that anxiety reduces but does not eliminate scaffolding's benefits. Thus, with appropriate scaffolding, even anxiety-prone learners can develop IS substantially beyond what conventional instruction provides. The challenge is not whether to scaffold anxious learners, but how to scaffold them in ways that minimize anxiety while maximizing cognitive support.

4.4 Theoretical Implications

This study provides empirical validation of Vygotsky's (1978) claim that higher mental functions develop through internalization of social interaction. The large scaffolding effect

demonstrates that external mediation can be successfully transformed into internal self-regulation, as measured by standardized IS instruments. However, the BIS moderation effect reveals a limitation in Vygotsky's original formulation: he emphasized the social-cognitive pathway (i.e., ZPD, scaffolding, internalization) but gave insufficient attention to how emotional factors might facilitate or impede this process. Our findings suggest that sociocultural theory requires integration with affective theories to fully explain language development.

4.5. Pedagogical Implications

The very large effect size ($d=2.08$) provides strong justification for investing time and effort in scaffolding. Teachers should explicitly incorporate scaffolding strategies designed to promote IS development, including modeling self-questioning, encouraging silent rehearsal before speaking, and gradually releasing responsibility as learners demonstrate self-regulation. Furthermore, teachers should assess learners' anxiety profiles and provide additional support for high-BIS learners. This might include creating low-stakes practice opportunities, providing more gradual scaffolding withdrawal, and explicitly addressing fear of negative evaluation. While scaffolding alone cannot eliminate anxiety's effects, combining scaffolding with anxiety-reduction strategies may optimize outcomes for all learners.

Conclusion

This study provides empirical evidence that teacher scaffolding significantly enhances IS development in Iranian EFL learners, with effect sizes indicating transformative rather than merely incremental benefits. The findings support Vygotsky's sociocultural theory by demonstrating that external social mediation can be internalized as cognitive self-regulatory tools. Importantly, this study reveals that learners' psychological profiles, specifically their anxiety sensitivity (BIS), moderate scaffolding effectiveness. While scaffolding benefits all learners, anxiety-prone individuals show reduced gains, highlighting the need for differentiated instruction that addresses both cognitive and emotional dimensions of language learning. These findings contribute to SLA theory by bridging sociocultural and biopsychological perspectives, demonstrating that effective language instruction must consider the interplay between social mediation, cognitive development, and individual emotional differences.

Limitations and Future Directions

Several limitations should be acknowledged. First, the sample was limited to advanced Iranian EFL learners at one institute, limiting generalizability. Future research should examine whether findings replicate across proficiency levels, age groups, and cultural contexts. Second, IS was measured through a self-report questionnaire, which may not fully capture actual IS use during learning. Future studies could incorporate think-aloud protocols or neuroimaging to provide more direct IS measures. Third, the intervention lasted eight weeks; longer interventions might reveal different patterns, particularly for high-BIS learners who may require more time to benefit from scaffolding.

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